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ADMINISTRATION

Date: March 23, 1990

NRA-90-OSSA-9

RESEARCH ANNOUNCEMENT

SPACE PHYSICS GUEST INVESTIGATOR PROGRAM

OMB Approval No. 2700-0042

SPACE PHYSICS GUEST INVESTIGATOR PROGRAM

NASA Research Announcement
Soliciting Research Proposals
for the Period Ending
June 22, 1990

NRA-90-OSSA-9
Issued: March 23, 1990

Office of Space Science and Applications
National Aeronautics and Space Administration
Washington, DC 20546

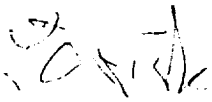
SPACE PHYSICS GUEST INVESTIGATOR PROGRAM

This NASA Research Announcement (NRA) solicits proposals for the support of guest investigator studies using the observations available from one or more of the following Space Physics Division flight programs: International Sun Earth Explorer (ISEE), International Cometary Explorer (ICE), Interplanetary Monitoring Platform (IMP), Active Magnetospheric Particle Tracer Explorer (AMPTE), San Marco D, Atmospheric Explorer (AE), and Dynamics Explorer (DE). These studies are desired in the general area of space physics, including cosmic and heliospheric physics, magnetospheric physics, and ionospheric physics. Note that Guest Investigator Programs for Solar Maximum Mission (NRA-89-OSSA-6) and Pioneers 10 and 11 (NRA-89-OSSA-7) have already been announced.

Participation in the program is open to all categories of organizations: educational institutions, other nonprofit organizations, industry, NASA Centers, and other Governmental organizations and to non-US scientists on a "no exchange of funds" basis. For the current Fiscal Year 1990 opportunity, a Letter of Intent to propose should be received by April 23, 1990, and proposals must be received by June 22, 1990. Selection for funding will be on the basis of peer review and is scheduled for completion by July 1990. Funding of selected proposals is expected to begin in September 1990. Proposals for Fiscal Year 1991 and 1992 funding from this program will be solicited through annual revisions of this NRA. The schedule for proposal submission and review is also given in Appendix A. Appendix B contains general guidance for the preparation of proposals. Appendix C provides model formats for summary pages. Appendix D contains brief descriptions of the missions and of the appropriate information resources.

Identifier:	NRA-90-OSSA-9
Submit Proposals and Letters of Intent to:	Mr. Michael A. Calabrese Space Physics Guest Investigator Program Code EPM-20 NASA Headquarters Washington DC 20546
Number of Copies Required:	10
Selecting Official:	Director, Space Physics Division Office of Space Science and Applications
Obtain Additional Information from:	See contacts listed in individual flight project descriptions (Appendix D).

Your interest and cooperation in participating in this effort are appreciated.



L. A. Fisk
Associate Administrator for
Space Science and Applications

Enclosures

NASA RESEARCH ANNOUNCEMENT

SPACE PHYSICS GUEST INVESTIGATOR PROGRAM

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SPACE PHYSICS GUEST INVESTIGATOR PROGRAM

I. Program Objective and Scope

The mission of the Space Physics Division of the NASA Office of Space Science and Applications is to support investigations of the origin, evolution, and interactions of particles and electromagnetic fields in space plasmas, and its interests range from the physics of the solar interior to the origin of cosmic rays. Its studies focus on (i) the interactions between the solar wind and solar system bodies, including studies of the ionospheres and magnetospheres of the Earth, other planets, comets, primordial bodies, and of magnetosphere-ionosphere-atmosphere interactions; (ii) the Sun as a star and as a source of solar system energy, plasma, and energetic particles; and (iii) the origin, acceleration, and transport properties of the solar wind and of solar and galactic cosmic rays. These studies are managed by the Division's four science branches: Cosmic and Heliospheric Physics, Solar Physics, Magnetospheric Physics, and Ionospheric Physics.

The Space Physics Division is responsible for the mission operations, data analysis, scientific studies, and archiving of information from flight programs that are directed primarily towards its scientific areas. This NRA solicits proposals for guest investigator support of the following projects:

1. Active Magnetospheric Particle Tracer Explorers (AMPTE)
   Charge Composition Explorer (CCE)
   Ion Release Module (IRM)
   United Kingdom Subsatellite (UKS)

2. Dynamics Explorers (DE) 1 and 2

3. International Sun Earth Explorers (ISEE) 1, 2, and 3

4. International Cometary Explorer (ICE)

5. Interplanetary Monitoring Platforms (IMP) 7 and 8

6. San Marco D

7. Atmospheric Explorers (AE) C, D, and E

Each of these projects is described in Appendix D. The routine acquisition, processing and initial analyses of the data sets and information from these projects has been conducted by the Principal Investigator (PI) teams selected for the mission through the Announcement of Opportunity (AO) process. Their research continues to be funded as Mission Operations and Data Analysis. Several of these projects already include participation by Guest Investigators. While many of the original scientific objectives of these projects have been successfully addressed,

it is appropriate to extend the scope of scientific problems and investigator efforts, using information resources provided by these flight projects. These resources are becoming more readily available through the National Space Science Data Center (NSSDC). Many of the research problems that can be addressed with these resources will prepare the scientific base for the International Solar Terrestrial Physics Program, which will have its first flight in 1992. To this end, the NRA invites proposals directed towards extending the scientific results obtained from the missions listed above.

II. Proposals More Appropriate to Other NASA Divisions and other NRAs

Some of these areas of study may overlap with research supported by other Divisions within the Office of Space Science and Applications, and prospective respondents to this NRA should carefully consider the following guidelines in choosing whether or not to submit their proposal to the Space Physics Division. Proposals dealing with solar-wind interaction with solar system bodies, planetary magnetospheres and ionospheres, particularly as compared to the Earth, are appropriate for this NRA. Proposals dealing with torii, rings, and planetary ionospheres and atmospheres should be directed to the Solar System Exploration Division. Proposals dealing with the Sun as a star in comparison with other stellar objects, and with cosmic x-rays and gamma-rays should be directed to the Astrophysics Division. Proposals dealing primarily with the chemistry and dynamics of the terrestrial mesosphere and below should be directed to the Earth Science and Applications Division. Proposals that have as their primary goal the development of innovative data analysis techniques should be directed to the Communications and Information Systems Division (NRA-89-OSSA-21). Proposals which are primarily for routine data processing and reduction are not appropriate to this NRA.

III. Proposals of Particular Interest

This Announcement solicits proposals for scientific investigations which fall within the general scope of the Division as defined in Section I, but which are not directly supported by specific space flight projects through the PI teams. Only tasks which are clearly distinguishable from ongoing efforts in support of Team Science Tasks (described in Appendix D) and from efforts already being pursued by individual PI teams will be considered for funding. Each proposal should focus on a specific scientific question to be addressed. Although the primary focus of a proposal must be a particular scientific question, efforts which result in the creation and contribution of new information-added data sets to the literature and Space Physics archives are especially encouraged.

Of particular interest under this program are:

1. Global studies of mass, energy, and momentum flows in the terrestrial magnetosphere using multispacecraft and supporting ground-based observations

2. Studies using spacecraft observations and numerical modeling techniques for interpretation and validation.

For the FY 1990 Guest Investigator Program, special consideration will be given to proposals involving investigations which make use of the observations of the several AMPTE spacecraft and the interpretation of such observations. Multispacecraft studies including AMPTE data are also of high priority.

IV. Relationship to Existing Mission Investigations

All US and non-US space scientists, including members of PI Teams for the flight programs listed in this NRA, are eligible to propose as guest investigators. Proposals that require additional processing of initial data sets, or proposals for access to processed data only available through PI Teams, will be considered.

Studies proposed under this NRA, however, must be carefully distinguished from studies conducted with project support, both scientifically and budgetarily. Basic descriptions of the flight projects are given in Appendix D, along with the principal references to published literature giving additional information. It is expected that most Guest Investigators will be able to make use of the data archived in the NSSDC. It is the responsibility of the proposer to carefully describe the information required (including any ancillary information) and to verify its availability through the Project Scientist and/or the PI Team contacts listed in Appendix D. A letter citing the availability of data and concurrence in any special arrangements with PI teams must be appended to the proposal.

V. Multiyear Funding

For selections being made in FY 1990, proposers may request periods of performance of one, two, or three years, although funding can be granted for only one year at a time. Proposals requesting multiyear funding should specify research goals to be achieved during each year of the proposed effort. In the case of multiyear awards, continued funding will be subject to the demonstration of satisfactory progress, as evidenced by a brief annual report. Continued funding will also be subject to the availability of funds. Funding levels for multiyear grants will be negotiated prior to the renewal of funding each successive year. It is anticipated that approximately $1.5M will be available in FY 1990, $2.5M in FY 1991, and $3.5M in FY 1992. Awards will be limited to $60,000 per investigation.

VI. Timetable

The schedule of events associated with this NRA for FY 1990 is:

Release of NRA	March 23, 1990
Letters of Intent due	April 23, 1990
Proposals due	June 22, 1990
Review completed	July 1990
Announcement of selections	August 1990
Beginning of funding	September 1990

For proposals being submitted for Fiscal Year 1991 or 1992 funding the schedule is expected to be:

Letters of Intent Due:	FY 1991: January 15, 1991
	FY 1992: January 15, 1992
Proposals Due	FY 1991: April 15, 1991
	FY 1992 April 15, 1992

VII. Guidelines for Proposing

Letter of Intent

A Letter of Intent to propose should be submitted to the program contact by April 23, 1990. The letter should describe the proposed investigation in two pages or less, and should also include the following information: (1) reference to NRA-90-OSSA-9, (2) statement of the science objective of the proposed task, (3) description of the data set(s) required, and (4) the names, addresses, and phone numbers of the Principal Investigator and of Co-Investigators (to the extent known).

Procedures

Proposals will be evaluated by mail-in reviews, which will be followed by a panel review. Recommendation for selection of proposals will take into consideration the comments of the reviewers, program suitability as described in Section III above, and the availability of funds. Final selections will be made by the Director of the Space Physics Division.

Details of the evaluation criteria appropriate to this NRA are listed in this appendix under "Evaluation Factors." Model proposal formats are provided in Appendix C. Summaries of the flight programs for each branch are provided in Appendix D.

Proposals submitted in response to this Announcement should, in general, follow the "Guidelines for Responding to NASA Research Announcements" in Appendix B, except for the following modifications:

(i) The "Conformance to Guidance" (Section 5) and "Proposal Contents" (Section 7) of Appendix B are modified as follows:

- The first four pages of each proposal constitute summary sheets and, for ease of evaluation, should approximate the sample formats in Appendix C.

(ii) The "Length" section (Section 9) of Appendix B is modified to require that:

- The complete project description should not exceed fifteen (15) pages of single-spaced 12-point type. A schedule and plan of work must be included. The nature of the data and software required by the investigator from the NSSDC and/or PI team must be specified. A description of any data products or software to be released to the NSSDC as results of this study should be included. This page count does not include the four summary pages. Details of the budget and bibliographies may be appended.

- Bibliographies should be limited to papers relevant to the proposed research, which have been published during the past ten years

- Do not send reprints, preprints, recordings, or videotapes.

iii) The "Proposed Costs" section (Section 7 i) of Appendix B is supplemented by the following information concerning proposal cost detail:

- The proposal should contain sufficient cost details and supporting information to facilitate a speedy evaluation and award. Dollar amounts proposed with no explanation (e.g., Equipment: $5,000, or Labor: $23,000) may cause delays. The proposed costing information should be sufficiently detailed to allow the Government to identify costed elements for evaluation purposes. Generally, the Government will evaluate costs as to reasonableness, allowability, and allocability. Each category should be explained. Offerors should exercise prudent judgement, since the amount of detail necessary varies with the complexity of the proposal.

Direct labor costs should be segregated by titles or disciplines (e.g., Principal Investigator, Co-Investigator, clerical support) with estimated hours, hourly rates, and total amounts for each. Estimates should include a basis of estimate such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess for reasonableness by various means, including comparison to similar skills at other organizations. Indirect cost should be explained to an extent that will allow the Government to understand the basis of the estimates.

With regard to other costs, each significant category should be detailed, explained, and substantiated. For example, proposals for equipment purchases should specify the type of equipment, number of units, and unit cost. Requested travel allowances should include the number of trips, duration of each trip, air fare, per diem, rental car expenses, and similar details.

Evaluation Factors

The following criteria are to be used instead of those included in Section 13, Appendix B "Guidelines for Responding to NASA Research Announcements." Evaluation criteria include:

- o the overall scientific and technical merit of the investigation
- o the capabilities of the investigator(s)
- o relevance of the proposed project to NASA flight programs
- o the likelihood that the proposed work will make a significant contribution to the field of space physics
- o presentation of a realistic work statement
- o reasonableness of cost to NASA i.e., cost realism, cost reasonableness, and relationship of proposed cost to total available funds.

VIII. Guidelines for Foreign Participation

NASA accepts proposals from all countries. Proposals from non-US entities should not include a cost plan. Non-US proposals, and US proposals that include non-US participation, must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-US participant is proposing. Such endorsement should indicate that:

(i) the proposal merits careful consideration by NASA
(ii) if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

Proposals, along with the requested number of copies and Letters of Endorsement, must be forwarded to NASA in time to arrive before the deadline established for this NRA. These documents should be sent to:

Mr. Albert Condes
International Relations Division
Code XID
NASA Headquarters
Washington, DC 20546
USA

All proposals must be in English. All non-US proposals will undergo the same evaluation and selection process as those originating in the US. Non-US proposals and US proposals that include non-US participation must follow all other guidelines and requirements described in this NRA.

All proposals must be received before the established closing date; those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Sponsoring non-US agencies may, in exceptional situations, forward a proposal without endorsement to the above address, if review and endorsement is not possible before the announced closing date. In such cases, however, NASA's International Relations Division should be advised when a decision on endorsement can be expected.

Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coodinating the NRA. Copies of these letters will be sent to the sponsoring government agency.

Should a non-US proposal or a US proposal with non-US participation be selected, NASA's International Relations Division will arrange with the non-US sponsoring agency for the proposed participation on a no exchange of funds basis, in which NASA and the non-US sponsoring agency will each bear the cost of discharging its respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) a letter of notification by NASA and/or
(ii) an exchange of letters between NASA and the sponsoring government agency.

APPENDIX B
TO NRA 90-OSSA-9

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS FOR SOLICITED RESEARCH PROPOSALS

(AUGUST 1988)

OFFICE OF PROCUREMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, DC 20546

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS FOR SOLICITED RESEARCH PROPOSALS

(AUGUST 1988)

1. FOREWORD

a. NASA depends upon industry, educational institutions and other nonprofit organizations for most of its research efforts. While a number of mechanisms have been developed over the years to inform the research community of those areas in which NASA has special research interests, these instructions apply only to "NASA Research Announcements," a form of "broad agency announcement" described in 6.102(d)(2) and 35.016 of the Federal Acquisition Regulation (FAR). The "NASA Research Announcement (NRA)" permits competitive selection of research projects in accordance with statute while at the same time preserving the traditional concepts and understandings associated with NASA sponsorship of research.

b. These instructions are Appendix I to 18-70.203 of the NASA Federal Acquisition Regulation Supplement.

2. POLICY

a. NASA fosters and encourages the submission of research proposals relevant to agency mission requirements by solicitations, "NASA Research Announcements," which describe research areas of interest to NASA. Proposals received in response to an NRA will be used only for evaluation purposes.

b. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

c. A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

3. PURPOSE

These instructions are intended to supplement documents identified as "NASA Research Announcements." The NRAs contain programmatic information and certain "NRA-specific" requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

4. RELATIONSHIP TO AWARD

a. A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded on the basis of a proposal submitted in response to an NRA. NASA does not have separate "grant proposal" and "contract proposal" categories, so all proposals may be prepared in a similar fashion. NASA will determine the appropriate instrument.

b. Grants are generally used to fund basic research in educational and nonprofit institutions, while research in other private sector organizations is accomplished under contract. Additional information peculiar to the contractual process (certifications, cost and pricing data, facilities information, etc.) will be requested, as necessary, as the

procurement progresses. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement (NHB 5100.4). Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NHB 5800.1).

5. CONFORMANCE TO GUIDANCE

a. NASA does not have any mandatory forms or formats for preparation of responses to NRAs; however, it is requested that proposals conform to the procedural and submission guidelines covered in these instructions. In particular, NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

b. In order to be considered responsive to the solicitation, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation. NASA reserves the right to reject any or all proposals received in response to an NRA when such action is considered in the best interest of the Government.

6. NRA-SPECIFIC ITEMS

a. Several proposal submission items will appear in the NRA itself. These include: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information.

b. Items included in these instructions may be supplemented by the NRA, as circumstances warrant. Examples are: technical points for special emphasis; additional evaluation factors; and proposal length.

7. PROPOSAL CONTENTS

a. The following general information is needed in all proposals in order to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

b. **Transmittal Letter or Prefatory Material**

(1) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(2) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(3) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(4) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(5) Identification of any other organizations that are currently evaluating a proposal for the same efforts;

(6) Identification of the specific NRA, by number and title, to which the proposal is responding;

(7) Dollar amount requested of NASA, desired starting date, and duration of project;

(8) Date of submission; and

(9) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

c. **Restriction on Use and Disclosure of Proposal Information**

It is NASA policy to use information contained in proposals for evaluation purposes only. While this policy does not require that the proposal bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

NOTICE

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

d. **Abstract**

Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective of the proposed effort and the method of approach.

e. **Project Description**

(1) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge in the field; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the general plan of work, including the broad design of experiments to be undertaken and an adequate description of experimental methods and procedures. The project description should be prepared in a manner that addresses the evaluation factors in these instructions and any additional specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Note, however, that

subcontracting significant portions of a research project is discouraged.

(2) When it is expected that the effort will require more than one year for completion, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should, of course, be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

f. Management Approach

For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and any necessary arrangements for ensuring a coordinated effort should be described. Aspects of any required intensive working relations with NASA field centers that are not logical inclusions elsewhere in the proposal should be described in this section.

g. Personnel

The principal investigator is responsible for direct supervision of the work and participates in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

h. Facilities and Equipment

(1) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use on the project.

(2) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for both research and non-research purposes should be explained.

i. Proposed Costs

(1) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel).

Estimate all manpower data in terms of man-months or fractions of full-time.

(2) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases. (Standard Form 1411 may be used).

(3) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 18-31 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

j. Security

Proposals should not contain security classified material. However, if the proposed research requires access to or may generate security classified information, the submitter will be required to comply with applicable Government security regulations.

k. Current Support

For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

l. Special Matters

(1) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(2) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

8. RENEWAL PROPOSALS

a. Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. It is not necessary that a renewal proposal repeat all of the information that was in the original proposal upon which the current support was based. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which extended support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

b. NASA reserves the right to renew an effort either through amendment of an existing contract or by a new award.

9. LENGTH

Unless otherwise specified in the NRA, every effort should be made to keep proposals as brief as possible, concentrating on substantive material essential for a complete understanding of the project. Experience shows that few proposals need exceed 15-20 pages. Any necessary detailed information, such as reprints, should be included as attachments rather than in the main body of the proposal. A complete set of attachments is necessary for each copy of the proposal. As proposals are not

returned, avoid use of "one-of-a-kind" attachments: their availability may be mentioned in the proposal.

10. JOINT PROPOSALS

a. Some projects involve joint efforts among individuals in different organizations or mutual efforts of more than one organization. Where multiple organizations are involved, the proposal may be submitted by only one of them. In this event, it should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

b. Where a project of a cooperative nature with NASA is contemplated, the proposal should describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. However, the proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which purport to specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

11. LATE PROPOSALS

A proposal or modification thereto received after the date or dates specified in an NRA may still be considered if the selecting official deems it to offer NASA a significant technical advantage or cost reduction.

12. WITHDRAWAL

Proposals may be withdrawn by the proposer at any time. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

13. EVALUATION FACTORS

a. Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

b. Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

c. Evaluation of its intrinsic merit includes the consideration of the following factors, none of which is more important than any other:

(1) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(2) The offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(3) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel who are critical in achieving the proposal objectives.

(4) Overall standing among similar proposals available for evaluation and/or evaluation against the known state-of-the-art.

d. Evaluation of the cost of a proposed effort includes the consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

14. EVALUATION TECHNIQUES

Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases, however, proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house where NASA has particular competence; others are evaluated by a combination of in-house people and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. Regardless of the technique, the final decisions are always made by a designated NASA selecting official. A proposal which is scientifically and programmatically meritorious, but which is not selected for award during its initial review under the NRA may be included in subsequent reviews unless the proposer requests otherwise.

15. SELECTION FOR AWARD

a. When a proposal is not selected for award, and the proposer has indicated that the proposal is not to be held over for subsequent reviews, the proposer will be notified that the proposal was not selected for award. NASA will notify the proposer and explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

b. When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation with the submitter. Formal RFPs are not used to obtain additional information on a proposal selected under the NRA process. However, the contracting officer may request certain business data and may forward a model contract and other information which will be of use during the contract negotiation.

16. CANCELLATION OF NRA

NASA reserves the right to make no awards under this NRA and, in the absence of program funding or for any other reason, to cancel this NRA by having a notice published in the Commerce Business Daily. NASA assumes no liability for cancelling the NRA or for anyone's failure to receive actual notice of cancellation. Cancellation may be followed by issuance and synopsis of a revised NRA, since amendment of an NRA is normally not permitted.

Appendix C to
NRA-90-OSSA-9

MODEL FORMATS

MODEL FORMAT: PAGE 1

PROPOSAL SUBMITTED IN RESPONSE TO NRA-90-OSSA-9
SPACE PHYSICS DIVISION RESEARCH AND ANALYSIS SUPPORT PROGRAM

PROGRAM AREA*:_____

TECHNIQUE AND RESEARCH AREA**:_____

DATA SETS TO BE USED
SPACECRAFT_____INSTRUMENT_____
SPACECRAFT_____INSTRUMENT_____

TITLE:_____

PRINCIPAL INVESTIGATOR:
Name:_____
Title:_____
Address:_____
E-Mail:_____
Telephone:_____
Signature and Date:_____

NAMES OF CO-INVESTIGATORS/SCIENTIFIC COLLABORATORS AND THEIR INSTITUTIONS:
Name/Institution:_____
E-Mail:_____

Name/Institution:_____
E-Mail:_____

Name/Institution:_____
E-Mail:_____

Name/Institution:_____
E-Mail:_____

AUTHORIZING INSTITUTIONAL OFFICIAL:
Name:_____
Title:_____
Address:_____
Telephone:_____
Signature and Date:_____

PROPOSED DURATION OF PROJECT AND TOTAL BUDGET:_____
FIRST YEAR BUDGET REQUEST:_____

*e.g, Magnetospheric, Ionospheric, or Cosmic and Heliospheric Physics
**e.g., Technique: Statistical, correlative, synoptic, multispacecraft, multi-instrument, spacecraft, ground
Research Area: Auroral physics, solar wind composition, substorm initiation, etc.

MODEL FORMAT: PAGE 2

PROPOSAL SUMMARY

TITLE:_____

PRINCIPAL INVESTIGATOR:_____
INSTITUTION:_____

CO-INVESTIGATOR(S):_____
(NAME(S) ONLY)_____

ABSTRACT
Type single-spaced within the outline provided below. Include (a) statement of scientific question being addressed, (b) outline of method for attacking this problem, (c) expected result, and (4) list of data sets to be used.

MODEL FORMAT: PAGE 3

BUDGET SUMMARY: FIRST YEAR

PRINCIPAL INVESTIGATOR:_____

PROPOSAL TITLE:_____

1.	Salaries and Wages.....	$_____
2.	Supplies and Materials.....	$_____
3.	Equipment Purchases.....	$_____
4.	Computer Time*.....	$_____
5.	Services.....	$_____
6.	Publications.....	$_____
7.	Communications**.....	$_____
8.	Travel.....	$_____
9.	Other (including benefits and overhead).....	$_____
10.	Total.....	$_____

* For researchers expecting to use Space Physics Division-reimbursed time on the Goddard NSEECC equipment, the cost of this time at $90/hr, CYBER 205 equivalent, must be shown here.

** Use of the Space Physics Analysis Network or the NASA Science Network, if required, must be estimated. Please provide here:

USERNAME:_____
NODE:_____
Check all that apply: E-Mail_____ File Transfer_____
Remote Login_____ Other (describe)_____
_____
_____

****

SUMMARY OF PERSONNEL (Nearest 0.1 workyears, nearest $K)

1.	Senior Personnel (give names).....	WY____	$_____
2.	Post-doctoral Associates (give names).....	WY____	$_____
3.	Students (give number).....	WY____	$_____
4.	Technical Support (give number).....	WY____	$_____
5.	Other.....	WY____	$_____
6.	TOTALS.....	WY____	$_____

MODEL FORMAT: PAGE 4

LIST OF CURRENT AND PENDING RESEARCH SUPPORT

This list should include all current research support from whatever source. It must include the proposed project and all other research requiring the time of the principal investigator. Please provide this information in the following form:

I. Name of Principal Investigator

A. Current Support

B. Pending Support (including renewal applications)

List separately for (A) and (B):

1. Source of support
2. Project title and sentence abstract
3. Award amount
4. Period covered by award
5. Person-months for proposed PI

II. Names of Co-Investigators

List (A) and (B) as shown above for each Co-Investigator

III. Other agencies to which this proposal has been or will be submitted

APPENDIX D to
NRA-90-OSSA-9

SPACE PLASMA PHYSICS FLIGHT MISSION DESCRIPTIONS

I. Summary

This appendix is intended to provide key references and points of contact so that proposers may develop specific research plans. It is expected that proposers responding to this NRA will have availed themselves of all of the pertinent references and resources given here and will construct specific and detailed research plans for the use of the various spacecraft observations. Further, the Project Scientists and Principal Investigators will assume that prospective proposers will have searched the principal references listed here and the obvious references listed therein before contact for further information is made. For the use of any data item that is not already held by the NSSDC and which requires Principal Investigator involvement to produce, the proposers must furnish evidence that a practical plan has been developed and agreed to by the Principal Investigator. For the use of items held by the NSSDC, such approval is not required but it is strongly encouraged that checks and coordination be made through the Project Scientists and Principal Investigators.

II. Resources and Capabilities of the National Space Science Data Center

This section provides an overview of the data presently available from the NSSDC relevant to this NRA, data ordering/access information, and other relevant services. Further details about NSSDC data holdings are available electronically from the NASA Master Directory, from a few NSSDC paper documents, and by query to NSSDC staffers. Each is further discussed/identified below.

The NASA Master Directory, developed and managed by NSSDC, is accessible as one option on the no-password NODIS (NSSDC Online Data and Information Services) captive account. To access from a SPAN node, SET HOST NSSDCA, then USERNAME = NSSDC.

Lower altitude spacecraft data relevant to this NRA are described in NSSDC Data Catalog 86-01 (issued 1986). Descriptions of data from spacecraft with apogees higher than 6.6 Re are found in catalog 88-11 (issued 1988). A "Data Listing" which serves as an index to all NSSDC data holdings, giving descriptive data set names, time spans, tape counts, etc., was issued in January 1988 and will be reissued in very early 1990.

Ordering of documents and of offline data sets (tapes, film, etc.) may be made by mail (NSSDC Request Coordination Office, Code 633.4, NASA Goddard Space Flight Center (GSFC), Greenbelt, MD 20771), telephone (301-286-6695), FAX (301-286-4952), SPAN message to NSSDCA::REQUEST, or by E-message to the NSSDC Request Coordinator (Ms. Liz Kennedy) via one option of the NODIS account described above. Small amounts of data will be provided free to successful respondents to this NRA. However, if more than a few tape replications are required, then a charge at the rate of $45/tape will be assessed.

Except as noted below, NSSDC data are typically available only offline. However, for a few data sets not routinely held online, software exists, or can be developed, for transient promotion of limited amounts of data to online status for electronic user access. This capability has been exercised for several past requesters of limited time spans of IMP 8 15-sec magnetic field data.

NSSDC manages the SPAN network. Relevant questions may be directed to David Peters at NSSDCA::PETERS or 301-286-2990.

General questions, not obviously addressable to individuals named elsewhere in this section may be addressed to Joseph King, NSSDCA::KING, 301-286-7355.

From each Atmospheric Explorer mission, NSSDC holds several tens of 15-sec resolution Unified Abstract tapes. No other data were routinely generated by the AE PIs. A pilot effort to migrate AE telemetry data to WORM optical disk has been initiated at the University of Texas at Dallas with NSSDC cognizance. Richard Horowitz (301-286-6314, NSSDCA::HOROWITZ) is the contact.

NSSDC holds AMPTE/CCE data from each PI at 1-6 min resolution on many tapes. Data holdings typically span the time period from the 1984 launch through 1986 or 1987. Limited amounts of AMPTE/IRM data, but no AMPTE/UKS data, are available at NSSDC. The NSSDC contact is "Sardi" Parthasarathy (301-286-8105, NSSDCA::SARDI).

NSSDC presently holds virtually no definitive Dynamics Explorer data. However, the DE PI teams are actively preparing data and supporting documentation for NSSDC at this time. The availability of significant volumes of DE data at NSSDC is on the order of months to one to two years away for many PI's. Richard Horowitz is the contact for NSSDC. See also Section IV below.

NSSDC holds much IMP 8 data, from most IMP instruments, some through 1988. Key data include 15 sec magnetometer data tapes, 1 - 2 min resolution solar wind plasma parameter data tapes, and hourly resolution proton fluxes above 6 threshholds from 1 to 60 MeV. The NSSDC contact is Joseph King.

NSSDC holds no San Marco data for wide distribution at this time. In fact, NSSDC is supporting the effort to process the San Marco telemetry data and distribute them to the US PI teams. The contact is Joseph King.

In addition to the mission-specific data sets identified above, NSSDC also generates, maintains, and updates the 1963-1988 hourly resolution interplanetary magnetic field and plasma compilation, often called the OMNItape. This data set is available on tape, in Data Books, and online through the NODIS account described above. The contact is Joseph King.

Coordinated Data Analysis Workshop (CDAW) databases are accessible for CDAW 8 (ISEE 3 deep tail periods) and for CDAW 9 (PROMIS). These databases contain data from many instruments on many spacecraft and on the ground, and, owing to their use of the Common Data Format, are not yet readily exportable to many sites. The contact is Robert McGuire (301-286-7794, NSSDCA::MCGUIRE).

NSSDC holds a number of empirical geophysical models, online and offline, related to magnetospheric magnetic fields, energetic trapped protons (AP87) and electrons (AE8), the ionosphere (International Reference Ionosphere), and the atmosphere (MSIS-86). One of the options of the above described NODIS account is access to these models. Many are available on floppy disk. The contact is Dieter Bilitza (301-286-9536, NSSDCA::BILITZA).

III. Active Magnetospheric Particle Tracer Explorers

1. Mission Summary

The Active Magnetospheric Particle Tracer Explorers (AMPTE) program is a three-nation, three-spacecraft mission designed to study the sources, transport, and acceleration of energetic magnetospheric ions and to study the interaction between clouds of cool, dense, artificially-injected plasma and the hot, magnetized, rapidly-flowing natural plasmas of the magnetospheric and solar wind. The three AMPTE spacecraft are the NASA Charge Composition Explorer (CCE), the Federal Republic of Germany's Ion Release Module (IRM), and the United Kingdom Subsatellite (UKS). All three were launched together on August 16, 1984, into near-equatorial elliptical orbits, with parameters given in Section 4. All contain extensive instrumentation (described in the reference material in Section 3), with the CCE and IRM providing the only existent complete data set on energetic ion spectra, composition and charge state throughout the near-earth magnetosphere. In addition, the IRM carried out eight major active ion releases-two releases of clouds of lithium ions in the solar wind in front of the magnetosphere (September 11 and 20, 1984), barium "artificial comet" releases in the dawn and dusk magnetosheaths (December 27, 1984 and July 18, 1985), and two each releases of lithium and barium ions in the near magnetotail (March 21; April 11, 23; May 13, 1985).

The IRM was operated real time, with approximately 45% coverage from launch until August 13, 1986. Five-second resolution digital data are available from the NSSDC (see Section II); for the availability of other data Dr. G. Haerendel or the instrument investigators should be contacted. The UKS was power-limited, and operated for selected portions of each orbit from launch until January 16, 1985. Color microfiche of the UKS survey plots and hardcopy of summary catalogues are available in the NSSDC; for digital data sets Dr. D. Bryant or the instrument investigators should be contracted.

The CCE contained a tape recorder, and its scientific data set is nearly continuous from shortly after launch until early 1989. The expanded CCE data set is quite large (approximately 72 Mbytes/day), and major emphasis was placed on providing effective visibility into all of the data for event identification and for correlative studies. To this end CCE Pool Files, and from them Pool Plots, were formed of most of the CCE data. These files are 6.4 minute averages in scientific units of electrons and ions from a large number of channels for all three particles instruments (including flux as a function of composition, charge state, energy, pitch angle, etc.), 68 second averages of B and 62 second averages of plasma wave channels. The files are formed "hands-off" in initial central processing and are not verified, but have proven very useful for a wide range of preliminary studies.

Most of the data in the CCE Pool Files are also displayed as CCE Pool Plots, with a complete set of plots for each orbit: line plot fiche for the magnetometer and waves data and color spectrograms for the particles instruments in 35-mm slide format, with approximately 60 types of color plots (flux, spectra, pitch angle distribution, composition, charge state, etc., from each instrument, with each plot covering the full orbit) in 17 to 23 color slides per orbit. These Pool Files and a set of the Pool Plots have been submitted to the NSSDC. It should be noted that while this data set is carefully produced, it does contain known data artifacts, uncompensated gain shifts, background, noise, etc., and should, in general, be used for detailed analysis only after consulting with the appropriate instrument investigator(s). All of the CCE data (Pool and the much large Summary and Master Files) are archived and accessible in the CCE Science Data Center.

CCE Science Data Center

The CCE Science Data Center (SDC) is an important innovative aspect of the CCE mission. The SDC, built around a VAX 11/785 and a number of VAX workstations located at The Johns Hopkins University Applied Physics Laboratory, is the central, dedicated data processing and analysis facility for the CCE. All of the CCE data have been processed into science analysis files and are archived (more than 120 Gbytes) there, and the scientific computing and graphics generation for the CCE science teams is carried out there, with teams accessing the SDC either locally or remotely via leased line, network, or dial-up connections. The SDC allows every CCE scientist to access quickly and use all of the mission data, ephemeris and attitude files, events and command logs, data indexes, and a number of utilities designed to make data access, analysis, and display easier.

All of the AMPTE science teams are strongly supportive of Guest Investigator involvement. Each instrument team is willing to assist and to the extent possible provide data to interested GI's. The CCE instrument teams will also assist investigators planning to use data from the CCE SDC, and the SDC plans to provide SPAN, dial-in or local access, GI accounts, and, if appropriate, staff aid in data processing. An information file for prospective GI's has been set up on the SDC and can be accessed via SPAN by setting host to AMPTE with username GUEST. More detailed information is included on the SDC, instrument coverage, data structure, utilities, etc. and on appropriate individuals to contact for more information on each data set and on the SDC. For any prospective proposer without access to SPAN, a printout of this information can be obtained by calling R. McEntire at (301) 953-5410.

2. US Principal Investigator

Dr. Richard McEntire
Applied Physics Laboratory
Johns Hopkins University
Johns Hopkins Road
Laurel, MD 20707
Telephone: 301 953 5410
SPAN: AMPTE::MCENTIRE

3. Principal References

Special Issue on the Active Magnetospheric Particle Tracer Explorers, IEEE Transactions on Geoscience and Remote Sensing, Volume GE-23, Number 3, May 1985(175-314).

McEntire, R. W., An Update on the Active Magnetospheric Particle Tracer Explorers (AMPTE) Program, Johns Hopkins APL Technical Digest, Vol. 8, No. 3, 340-347, 1987.

An information file containing an AMPTE bibliography, a list of appropriate investigators to contact for more detailed information on each instrument data set (with telephone numbers and SPAN addresses), and a description of the CCE Science Data Center and its data archives, can be obtained over SPAN by setting host to AMPTE with username GUEST, or by calling R. McEntire at (301) 953 5410.

4. Mission Characteristics

Name	CCE	IRM	UKS
Launch Date	Aug. 16, 1984	Aug. 16, 1984	Aug. 16, 1984
Status	Terminated 7/14/89	Terminated 8/13/86	Terminated 1/16/85
Apogee	8.8 Re	18.8 Re	18.8 Re
Perigee	1100 km	550 km	550 km
Inclination	4.8°	28.8°	28.8°
Period	15.6 hours	44.3 hours	44.3 hours
Spin Vector	In orbit plane 10°-20° off of sun	Slowly torqued to Normal to Ecliptic	Normal to Ecliptic
Spin Rate	10.2 rpm	13.6 rpm	12 rpm

5. **AMPTE Investigators**

AMPTE/CCE	Principal Investigator	Phone/SPAN Address
Principal Investigator for the AMPTE/CCE Program	McEntire, R. W. Johns Hopkins U/APL	301 953 5410 AMPTE::MCENTIRE
Hot Plasma Composition	Shelley E. G. Lockheed Palo Alto Res. Lab	415 424 3253 AMPTE::KLUMPAR
Charge-Energy-Mass Spectrometer	Gloeckler, G. U. of Maryland	301 454 3135 AMPTE::GLOECKLER
Medium Energy Particle Analyzer	McEntire, R. W. Johns Hopkins U./APL	301 953 5410 AMPTE::MCENTIRE
Magnetic Field Expt.	Potemra, T. A. Johns Hopkins U./APL	301 953 5413 AMPTE::POTEMRA
Plasma Wave Inv.	Strangeway, R. L. U. of California at Los Angeles	213 206 6247 AMPTE::STRANGEWAY

AMPTE/IRM

Principal Investigator for AMPTE/IRM Program	Haerendel, G. Max Planck Institute Garching	49 89 3299516 MPE::HAE
Li/Be Release Experiment	Haerendel, G. Max Planck Institute Garching	49 89 3299516 MPE::HAE
Fluxgate Magnetometer	Luhr, H. Tech. U. Braunschweig	49 5313915222
Plasma Instrument	Paschman, G. Max Planck Institute Garching	49 89 3299868 MPE::GEP
Plasma Wave Experiment	Haerendel, G. Max Planck Institute Garching	49 89 3299516 MPE::HAE
Ion Time-of-Flight Spectrometer	Mobius, E. Max Planck Institute Garching	49 89 3299576 MPE::SEM

AMPTE/UKS

Project Scientist for the AMPTE/UKS Program	Bryant, D. A. Rutherford Appleton Laboratories	44 235 446515 19587::DAB
Three-Dimensional Ion Experiment	Johnstone, A. D. Mullard Space Sciences Laboratory	44 483 274111 19709::ADJ
The Electron Experiment	Hall, D. S. Rutherford Appleton Laboratories	44 235 446503 19587::DSH
Fluxgate Magnetometer Experiment	Southwood, D. J. Imperial College, London	44 1 589 5111 RLESIS::CBS%UK.AC.IC.PH. SPVA::SOUTHWOOD
The Wave Experiment	Woolliscroft,L. Univ. of Sheffield	44 742 768555 19587::LJCW

IV. Dynamics Explorer 1 and 2

1. Mission Summary

Following an August 1981 launch, the two spacecraft became operational during September. The initial orbit parameters are provided below. Because of their ~90 degree inclinations, the orbits remained very nearly coplanar during their joint lifetimes. This orbital configuration provided the unique capability of acquiring data at two altitudes along common magnetic flux tubes. DE 2, in its orbit at ionospheric altitudes, reentered the atmosphere in February 1983. DE 1, at much higher altitudes and passing through the heart of the magnetosphere, is still operational. With an apsidal precession rate of about 1/3 degree per day, DE 1 apogee had completed two revolutions around the Earth by September 1987. Since its orbital configuration very nearly repeats itself every 3 years, the longer DE 1 lifetime allows excellent data acquisition for the study of solar cycle effects on the magnetospheric plasma properties.

Both spacecraft were power-limited, though DE 1 had at times a duty cycle of 90% early in the mission. More recently, it has been in the 16 - 55% range. DE 2 had a duty cycle which varied between 16 and 36%. Because of the limitations of operations, considerable effort was expended in selecting those portions of the orbits for data acquisition to maximize the science return. Times of magnetic conjunction between the spacecraft, or between one spacecraft and a collaborating ground observatory, were given very high priority.

Data acquisition during passages of the spacecraft through special geophysical regions like the dayside cusp and plasmapause were emphasized. Data were also sought during specific orbital configurations, such as periods when DE 1 apogee was near the magnetic equator, which provided long orbit arc segments nearly along a magnetic field shell, or sequences of DE 2 passes across the northern auroral region when DE 1, high over the polar cap, acquire long periods of auroral images. This schedule planning effort was accomplished through the establishment of science operations coordinators and support from the NSSDC. A file of magnetic conjunctions between DE 1 and DE 2 exists in the NSSDC computer and is accessible through the SPAN network. A user's guide to the data base can be obtained from the Project Scientist.

Data System

The DE data processing and analysis system has evolved from the unique centralized data system inherited from the AE program to a very modern distributed data system. A key ingredient of the data-handling system has been the generation and distribution of quality summary plots on microfiche. Extracted data from each instrument on a spacecraft are plotted on common time scales, with each fiche holding data from a single satellite pass. While the data are processed using relatively simple algorithms and are unverified, these fiche have been an invaluable resource in the analysis effort. They allow the identification of various types of events or phenomena in the data for which more completely processed data can then be obtained. Microfiche have been generated for the entire DE 2 operation, and DE 1 fiche are complete to about 1 and 1/2 months from the present time. A user's guide to the summary plots provides examples of the types of events which can be identified in the data. A complete set of microfiche with updated user's guide will be submitted to the NSSDC.

The DE investigators are cooperating with the NSSDC in a pilot project for a modern procedure for submitting data to and accessing data from the NSSDC. A DE spacecraft directory has been established in the NSSDC master directory system whereby anyone with access to the NSSDC computer can determine the data sets in existence and their locations. If desired, the

inquirer can be routed to the instrument catalog, independently of whether it resides at the NSSDC or at the instrumenter's own facility. From the local instrument catalog, detailed information about the data sets may be obtained. During the period when a data set is dynamic, (i.e. when it is being worked on and added to) it will reside, together with its catalog, at the instrumenter's facility. When the data set becomes static, it will be transferred with its catalog to the NSSDC. This transfer will occur on WORM (write once, read many) optical disks. Transfer of these data sets is expected to begin in 1990 and to be completed during 1992.

(All material in this section is reproduced from "Dynamics Explorer: 5 Years Later" by Robert A. Hoffman which appeared in Reviews of Geophysics, Volume 26, Number 2, May 1988, pp. 212-213.)

The DE Science Team science objectives for FY 1990, 1991, and 1992 include studies of (1) plasma physics of the auroral acceleration region, (2) dynamical interactions between the thermosphere and the magnetosphere, (3) the ionosphere as a source of plasma for the magnetosphere, and (4) electrodynamic coupling as a function of substorm phase and IMF direction.

2. Project Scientist

Dr. Robert A. Hoffman
Code 696
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
Telephone: 301 286 7386
SPAN DE696::U6RAH

3. Principal References

Dynamics Explorer, ed. R.A. Hoffman, Space Science Instrumentation, Volume 5, Number 4, D. Reidel Pub. Co., Boston, 1981(344-573).

The Dynamics Explorer Program: 5 Years Later, ed. R.A. Hoffman, Reviews of Geophysics, Volume 26, Number 2, American Geophysical Union, Washington, 1988(209-367).

4. Mission Characteristics

Name	DE 1	DE-2
Launch Date	August 3, 1981	August 3, 1981
Status	Operating	Re-entered February 1983
Apogee	3.63 Re	1012 km
Perigee	570 km	309 km
Inclination	89.91 degrees	89.99 degrees

Period	6 h. 49 min.	98 min.
Spin Vector	Antiparallel to orbit normal	Z axis parallel to orbit normal Y axis parallel or antiparallel to zenith
Spin Rate	10 rpm	1 rpo

5. Dynamics Explorer Investigators

Dynamics Explorer 1

Investigation	Principal Investigator	Phone	Institution
High Altitude Plasma Instrument	Burch, J. L.	512 684 5111 x2526	Southwest Research Institute
Retarding Ion Mass Spectrometer	Chappell, C. R.	205 453 3036	Marshall Space Flight Center
Global Auroral Imager	Frank, L. A.	319 335 1695	University of Iowa
Plasma Wave Instrument	Gurnett, D. A.	319 335 1697	University of Iowa
Controlled and Naturally Occurring Wave-Particle Interactions Analysis	Helliwell, R. A.	415 497 3582	Stanford University
Energetic Ion Mass Spectrometer	Shelley, E. G.	415 858 4053	Lockheed Palo Alto Research Laboratory
Magnetometer	Slavin, J. E.	301 286 5839	Goddard Space Flight Center

Dynamics Explorer 2

Low Altitude Plasma Instrument	Winningham, J. D.	512 684 5111 x3075	Southwest Research Institute
Magnetometer	Slavin, J. E.	301 286 5839	Goddard Space Flight Center

Wind and Temperature Spectrometer	Spencer, N. W.	301 286 5001	Goddard Space Flight Center
Langmuir Probe	Brace, L. H.	301 286 8575	Goddard Space Flight Center
Neutral Mass Spectrometer	Carignan, G. R.	313 764 9462	Univ. of Michigan
Retarding Potential Analyzer	Hanson, W. B.	214 690 2851	Univ. of Texas at Dallas
Fabry-Perot Interferometer	Killeen, T. L.	313 747 3430	Univ. of Michigan
Ion Drift Meter	Heelis, R. A.	214 690 2853	Univ. of Texas at Dallas
Vector Electric Field Instrument	Maynard, N. E.	617 861 3989	Air Force Geophysical Laboratory

Interdisciplinary Scientists

Atmospheric Dynamics and Energetics	Mayr, H. E.	301 286 7505	Goddard Space Flight Center
Magnetospheric Energy Coupling to Atmosphere	Kozyra, J. U.	313 747 3550	Univ. of Michigan
Neutral-Plasma Interactions	Roble, R. F.	303 497 1562	Nat'l Center for Atmospheric Research
Auroral Physics	Maggs, J. E.	213 825 7497	Univ. of California at Los Angeles

V. International Sun Earth Explorers 1, 2, and 3 and International Cometary Explorer

1. Mission Summary

The ISEE spacecraft have had long, varied, and productive orbital operations as shown in the mission summary given in 4. The first launch carried the ISEE 1 and 2 spacecraft into very nearly identical orbits. ISEE 2, which was sponsored by the European Space Agency, carried maneuvering capability so that its separation distance from ISEE 1 could be controlled. Extensive

studies of the bow shock, magnetopause, and interplanetary shock structures and transitions have been enabled via the comparison of similar parameters simultaneously measured on ISEE 1 and 2, which operated at separations ranging from a few kilometers up to tens of thousands of kilometers. The companion spacecraft, ISEE 3, was launched into a halo orbit in the vicinity of the upstream Earth-Sun libration point, L1. Generous maneuvering capability enabled it to stationkeep on this orbit for about 4 years and then to be targeted through a complex series of lunar encounters towards a flyby of the comet Giacobini-Zinner, passing twice through the deep magnetotail tail enroute. When the comet phase of the mission began, it was officially renamed International Cometary Explorer.

ISEE 1 and 2 Science Team science objectives for FY 1990, 1991, and 1992 focus on (1) formation and dynamics of the magnetosheath and its boundaries, and (2) geomagnetic storms. Elements of the second study include (a) response of the magnetosphere to the solar wind, (b) the cause of the onset of the storm, (c) decay of the ring current, (d) development of the main phase, and (e) global energetics.

ICE Science Team science objectives for FY 1990, 1991, and 1992 focus on (1) cosmic-ray measurements in the context of the Coordinated Outer Heliosphere Observations program, (2) coronal mass ejections and their associated interplanetary shocks, and (3) solar flare produced energetic particles.

In addition to extensive contributions from individual investigations on ISEE 1, 2, and 3, the NSSDC has a copy of the Pool Tape and plots which captured the general appearance of the particle and field environment and can be used to identify features for further study. It is important to emphasize that the Pool data were provisional and may contain artifacts of instrument operation. Any publication or extensive calculation based on Pool data is, therefore, at risk of error until and unless the data in question are reviewed by the investigator responsible for obtaining it. Among the compilations that have resulted from ISEE studies that may lend themselves as inputs to future studies are the list of interplanetary shock observations and bow-shock and magnetopause-crossing events.

2. Project Scientist ISEE 1, 2, and 3 and ICE

Dr. Keith W. Ogilvie
Code 692
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
Telephone: 301 286 5904
SPAN LEPVAX::U2KWO

3. Principal References

Special Issue on Instrumentation for the International Sun-Earth Explorer Spacecraft, IEEE Transactions on Geoscience and Electronics, Volume GE-16, Number 5, July, 1978 (151-280)

Formisano, V. "The International Sun Earth Explorer Mission--ISEE-2", The IMS Sourcebook, Russell and Southwood, eds., American Geophysical Union, 2000 Florida Avenue NW, Washington, DC, 20009, 1982 (27-36).

Ogilvie, K. W., "Availability of ISEE-1 Data for the IMS Period", The IMS Sourcebook, Russell and Southwood, eds., American Geophysical Union, 2000 Florida Avenue NW, Washington, DC, 20009, 1982 (21-26).

Tsurutani, B. T., and T. T. von Rosenvinge, ISEE-3 Distant Geotail Results, Geophys. Res. Let., 11, 1984 (1027-1029)..

von Rosenvinge, T. T., "Data from ISEE-3 Data for the IMS Period", The IMS Sourcebook, Russell and Southwood, eds., American Geophysical Union, 2000 Florida Avenue NW, Washington, DC, 20009, 1982 (1-9).

von Rosenvinge, T. T., J. C. Brandt, and R. W. Farquhar, The International Cometary Explorer Mission to Comet Giacobini-Zinner, Science, 232, 1986, (353-356).

4. Mission Characteristics

Name	ISEE-1	ISEE-2	ISEE 3/ICE
Launch Date	Oct. 22, 1977	Oct. 22, 1977	August 12, 1978
Status	Re-entered Sept., 1987	Re-entered Sept., 1987	L1 Halo Orbit ended 9/1/82 Geotail Transits Sept. 82-Dec. 22,1983 ICE Mission Dec. 22, 1983 Comet Flyby Sept. 11, 1985 Currently orbiting the Sun at 1 AU, leading the Earth by ~ 60 degrees
Apogee	23 Re	23 Re	n/a
Perigee	270 km.	270 km.	n/a
Inclination	23 degrees	23 degrees	n/a
Period	57.2 hrs	57.2 hrs	n/a
Spin Vector	Normal to Ecliptic	In ecliptic (launch to autumn '79) Normal there-after	Normal to Ecliptic
Spin Rate	20 rpm	19.8 rpm	20 rpm

5. International Sun Earth Explorer 1 Investigators

Investigation	Principal Investigator	Phone	Institution
Electric Waves: 10 Hz-2 MHz Magnetic Waves: 10 Hz-2 kHz	Gurnett, D. A.	319 335 1697	University of Iowa
Magnetometer	Russell, C. T.	213 825 3188	Univ. of Calif. at Los Angeles
Protons: 1 eV-50 keV Electrons: 1 eV-50 keV	Frank, L. A.	319 335 1695	University of Iowa
Solar Wind Ions: 10 eV/nuc-10 keV/nuc	Gosling, J. T.	505 667 5389	Los Alamos National Lab.
Electron Density	Harvey, C. C.		Observatorie de Meudon
Protons: 5 eV-40 keV Electrons 5 eV-20 keV	Gosling, J. T.	505 667 5389	Los Alamos National Lab.
Protons: 25 keV-2 MeV Electrons: 20-250 keV	Williams, D. J.	301 953 5405	Johns Hopkins Univ./Applied Physics Laboratory
Protons: 8-380 keV Electrons: 8-200 keV	Anderson, K. A.	415 642 1313	Univ. of Calif. Berkeley
Electric Fields	Aggson, T. A.	301 286 5726	Goddard Space Flight Center
Electric Fields	Cattell, C. A.	415 642 2545	Univ. of Calif., Berkeley
Cold Plasma Composition	Lennartson, O. W.	415 424 3259	Lockheed Palo Alto Research Lab.
Energetic Particle Composition	Ipavich, F (Hovestadt is PI, Ipavich is US contact)	301 454 7315	Univ. of Maryland
Low Energy Electrons 5 eV - 5 keV	Ogilvie, K. W.	301 286 5904	Goddard Space Flight Center

International Sun Earth Explorer 2 Investigators

Investigation	Principal Investigator	Phone	Institution
Electric Waves: 10 Hz-2 MHz Magnetic Waves: 10 Hz-2 kHz	Gurnett, D. A.	319 335 1697	University of Iowa
Magnetometer	Russell, C. T.	213 825 3188	Univ. of California at Los Angeles
Protons: 1 eV-50 keV Electrons: 1 eV-50 keV	Frank, L. A.	319 335 1695	University of Iowa
Solar Wind Ions: 10 eV/nuc-10 keV/nuc	Egidi, A		C.N.R. Frascati, Italy
Electron Density	Harvey, C. C.		Observatorie de Meudon
Protons: 5 eV-40 keV Electrons 5 eV-20 keV	Paschman, G.		Max Planck Institute Garching
Protons: 25 keV-2 MeV Electrons: 20-250 keV	Williams, D. J.	301 953 5405	Johns Hopkins Univ.
Protons: 8-380 keV Electrons: 8-200 keV	Anderson, K. A.	415 642 1313	Univ. of California, Berkeley

International Sun Earth Explorer 3 Investigators

Investigation	Principal Investigator	Phone	Institution
Electric Waves: 20 Hz-100 kHz Magnetic Waves: 20 Hz-1 kHz	Greenstadt, E. W.	213 812 0078	TRW Systems
Type III Radio Bursts	Steinberg, J.		Observatorie de Meudon
Magnetometer	Smith, E.	415 354 0953	Jet Propulsion Laboratory

Protons and Electrons: 150 eV-7 keV	Gosling, J. T.	505 667 5389	Los Alamos National Lab.
Protons: 30 keV-1.4 MeV	Hynds, R.		Imperial College, London
Electrons: 2 - 800 keV Solar X-rays; 6 - 250 keV	Anderson, K. A.	415 642 1313	Univ. of California, Berkeley
Plasma Composition	Ogilvie, K. W.	301 286 5904	Goddard Space Flight Center
Energetic Particle Comp. up to 20 MeV/nucleon	Ipavich, F. Hovestadt is PI, Ipavich is US contact)	301 454 7315	Univ. of Maryland
Energetic Particle Comp. 2-20 MeV/nucleon	Stone, E.	213 356 4241	Caltech
Energetic Particle Comp. 31-495 MeV/nucleon	Heckman, H.		Univ. of California, Berkeley
Energetic Particle Comp. 0.5-500 MeV/nucleon	von Rosenvinge,T.	301 286 6721	Goddard Space Flight Center
Electron Energy Spectra: 5-400 MeV	Meyer, P.	312 962 7845	Univ. of Chicago

VI. Interplanetary Monitoring Platforms 7 and 8

1. Mission Summary

These were the final two launches of the IMP series and they have had long and productive orbital operations as shown in the mission summary given in 4. below (from King, 1982). In addition to extensive contributions from individual investigations on IMP,s 7 and 8, the NSSDC has several noteworthy data sets derived in part or principally from IMP 7 and 8 observations. These are:

o The OMNItape and Interplanetary Medium Data Book (King, J.W., NSSDC publication 89-17, September 1988) in which solar wind and interplanetary magnetic field are tabulated at time resolutions of a few minutes for 1963-1988.

o The Solar Particle Data Set in which hourly and daily averaged solar flare proton fluxes are tabulated for thresholds of 10, 30, and 60 MeV for the period 1963 to the present. For the period from the launch of IMP 7 to the present, thresholds of 1, 2, and 4 MeV are also available.

o The Merged Data Set in which magnetic field, plasma, and energetic particle observations are available in a simple, time ordered file, reduced to a common time base of 20.24 seconds. It is expected that production of this data set will be complete from IMP 8 launch to the present by July of 1990.

2. Project Scientist

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Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
Telephone: 301 286 7355
SPAN NSSDCA::KING

3. Principal Reference

King, J.H., "Availability of IMP-7 and 8 Data for the IMS Period", The IMS Sourcebook, Russell and Southwood, eds., American Geophysical Union, 2000 Florida Avenue N.W., Washington, D.C., 20009, 1982 (10-20).

4. Mission Characteristics

Name (Alternates)	**IMP 7 IMP H Explorer 47**	**IMP 8 IMP J Explorer 50**
Launch Date	Sept. 23, 1972	Oct. 26, 1973
Status	Turned off, Oct. 1978	Operating
Apogee	30-40 Re	37-45 Re
Perigee	30-34 Re	25-33 Re
Inclination	10-44 degrees	20-55 degrees
Period	12.6 days	12.55 days
Spin Vector	Normal to Ecliptic	Normal to ecliptic
Spin Rate	46 rpm	22 rpm

5. **Investigators - IMP 7 and 8**

Investigation	**Contact**	**Phone**	**Institution**
Electric Waves: 40 Hz-178 kHz Magnetic Waves: 40 Hz-1.78 kHz	Gurnett, D. A.	319 335 1697	University of Iowa
D.C. Electric Field	Aggson, T. L.	301 286 5726	Goddard Space Flight Center

Magnetometer (Triaxial fluxgate)	Lepping, R. P.	301 286 5413	Goddard Space Flight Center
Protons & electrons: 50 eV-45 keV	Frank, L. A.	319 335 1695	University of Iowa
Solar Wind Ions: 50 eV-2 keV	Lazarus, A. J.	617 253 4284	MIT
Plasma Distribution Function	Gosling, J. T.	505 667 5389	Los Alamos National Lab.
Energetic Particle Experiment	Williams, D. J.	301 953 5405	Johns Hopkins University
Charged Particle Meas. Experiment	Krimigis, S. M.	301 953 5287	Johns Hopkins University
Cosmic Ray	McGuire, R. E.	301 286 7794	Goddard Space Flight Center
Cosmic Ray	Simpson. J. A.	312 753 8612	Univ. of Chicago
Electron & Isotope Spectrometer	Stone, E. C.	818 356 4241	Caltech
Ion and Electron Spectrometer	Ipavich, F.	301 454 7315	Univ. of Maryland

Investigators - IMP 7 only

Gamma Ray Bursts	Cline, T. L.	301 286 8375	Goddard Space Flight Center
Plasma Electrons	Ogilvie, K. W.	301 286 5904	Goddard Space Flight Center
Plasma Waves	Scarf, F. L. (deceased) Joe King	301 286 7355	Goddard Space Flight Center

VII. San Marco D

The San Marco project launched a scientific satellite March 26, 1988, for study of various properties of the equatorial thermosphere and ionosphere. The program is a cooperative research effort of I1 Centro Richerche Aerospatiali of the University of Rome, Italy, and NASA (Goddard Space Flight Center). There is also an auxiliary cooperative agreement between the University of Rome and the Deutsche Forschungs and Versuchsanstalt fur Luft und Raumfahrt (DFVLR) of the Federal Republic of Germany. The planned scientific program of the satellite was substantial; moreover a number of ground-based facilities were able to operate several times in conjunction with the satellite to obtain correlative measurements, making possible an even more comprehensive program of scientific investigation of the equatorial regions. This document summarizes the spacecraft systems design and capability, and provides other information useful for the guest investigator program.

San Marco Science Goals

Study the structure, dynamics, and aeronomy of the equatorial thermosphere through investigation of:

o the relationship between density, composition, temperature, and airglow as a function of solar flux and f10.7 flux

o the interhemisphere transport of ions and neutral particles

o the dependency of the neutral wind, ion drag, temperature, and particle densities in local time

o the relationship between neutral wind and the electric field

o ionosphere irregularities and special events and other parameters keyed to longitude

o the equatorial distribution of ozone

o magnetic storm-induced variations in the measured parameters

o the dependency of the correlation between the meridional wind and ion drift on the magnetic field

o the variation of the midnight temperature maximum

Description of the Satellite System

San Marco D was approximately spherical and about 1 meter in diameter. It weighed about 237 kg and had a basic physical structure similar to earlier spacecraft in the series, required by the Italian atmospheric density (drag balance) instrument that forms an integral part of the satellite. Thus, the outer shell was very light and was attached to the inner relatively heavy mass through an elastic element that permitted translation of the outer shell with respect to the inner mass. The relative translations were converted to voltages proportional to the drag force providing a measure of the atmospheric density.

The spacecraft was launched by a Scout rocket into an orbit (260 km x 615 km) having an inclination of about 2.9 degrees. Solar cells mounted near the equator of the inner structure were illuminated through thin mica portions of the outer shell, which preserved the aerodynamic surface while being nearly transparent. A magnetic attitude control system permitted control of both the spin axis pointing and the spin rate (6 RPM). Attitude control was referenced to the positions of both the horizon and the sun. A star sensor provided attitude information for early calibration of the horizon and sun sensors before it ceased operation several weeks after launch.

The onboard digital data system included two tape recorders and appropriate telemetry for transmission to a single ground telemetry station located at the Italian ground complex about 40 km north of Malindi, Kenya on the shore of the Indian Ocean. Data recorded there were transmitted to the control center in Rome through leased lines. Commands were transmitted from the single

ground station, which due to its location and the low inclination of the orbit, could be received by the satellite every orbit. Many commands were executed in real time; however, stored commands for remote turn-on of the system and instruments were also used extensively.

The spacecraft power system permitted about 90 minutes of scientific instrument operation per day. Spacecraft system requirements for maintaining attitude, tape recorder playback, commanding, and general system operation required the equivalent of about 30 minutes per day. The spacecraft reentered December 6, 1988, about as predicted.

Scientific Instrumentation and Investigators

Neutral Atmosphere Density (Drag Balance) (DBI)

PI:	Professor L. Broglio (CRA)	University of Rome
Co-Is:	Professor Ugo Ponzi	University of Rome
	Professor Carlo Arduini	University of Rome

The measure of density is determined by measuring the relative displacement between the low mass outer shell and the massive main structure (237 kg) of the satellite. The relative translation is converted to a voltage which is proportional to the drag force on the satellite. The sensitivity of the system permits measurements at altitudes as high as several hundred kilometers. Any of four ranges can be selected to optimize operation. In-flight calibrations are provided, and passage at apogee provides a calibration point near zero density.

Ion Velocity Instrument (IVI)

PI:	Dr. W. B. Hanson	University of Texas at Dallas
Co-I:	Dr. R. Heelis	University of Texas at Dallas

The Ion Velocity Instrument measures the three-dimensional bulk velocity of the ambient ions in the spacecraft velocity frame. In addition, the instrument measures the ambient plasma concentration and the ion temperature. The instrument is a derivative of instrumentation successfully developed on the AE and DE satellites. It uses a planar Retarding Potential Analyzer to determine the magnitude of the relative speed between the thermal ions in the F region and the satellite. A square aperture collimator and a split collector are used to determine the arrival angle of ions incident upon another sensor. The combination of these measurements yields the three-dimensional bulk velocity vector of the ambient ions in the spacecraft frame, and since the spacecraft velocity is accurately know, the ion velocity in the Earth's frame can be simply determined. A complimentary feature of the San Marco D payload is a negatively biased, axially symmetrical, ion collector ring, whose current is measured to provide continuous ion concentration measurements.

Wind and Temperature Spectrometer (WATI)

PI:	N. W. Spencer	GSFC (Univ. Res. Found.)
Co-Is:	L. E. Wharton	University of Michigan
	G. R. Carignan	University of Michigan
	J. M. Maurer	University of Michigan

Two components of the wind, one horizontal and normal to the orbit plane, and the other vertical in the orbit plane, and the kinetic temperature, will be measured using a technique developed for AE and DE satellites but modified for a spinning spacecraft. One measurement can be made during each spin cycle, in addition to a determination of the neutral composition. The technique employs a scanning baffle which modulates the particle flow into the entrance port of a mass spectrometer. A density vs. time measurement of a selected gas species usually molecular nitrogen or atomic oxygen, is made. As a result of the modulated flow, the direction of the incoming flux of particles with respect to the spacecraft can be determined the wind components calculated. Also, from the shape of the density vs. time curve, the velocity distribution, and hence the temperature is calculated. This instrument failed approximately five weeks into the mission.

Ref. (DE Inst.) Space Science Inst., 5, 1981.

3-Axis Electric Field Instrument (EFI)

PI:	Dr. N. C. Maynard	Air Force Geophysical Lab.
Co-Is:	Dr. J. P. Heppner	GSFC
	Dr. T. L. Aggson*	GSFC
	Dr. R. F. Pfaff	GSFC

* Acting PI beginning a few months before launch

The electric field sensors of this experiment consist of two orthogonal twenty-meter (tip-to-tip) wire antennas to be extended in the spin plane of the satellite and a more rigid 6 m (tip-to-tip) antenna to be deployed along the spacecraft spin axis. The instrument utilizes these antennas as a double floating probe to measure the dc electric field with 0.125 second resolution in the realtime domain and the rms wave electric field in filter banks from 4 to 10,000 Hz in the frequency domain. The dc electric field measurements will extend data analysis to quantitatively subtract the -VxB field (the order of 200 mV/m at equatorial latitudes)in the F-region. These convective electric field measurements, with ground-based plasma drift observations, provide a critical morphology survey of equatorial electrodynamics.

Airglow Solar Spectrometer (ASSI)

PI: Dr. Gerhardt Schmidke
Physikalisch-Technische Studien G.M.B.H.
Freiburg, West Germany (FRG)

The Airglow Solar Spectrometer measured the air glow, solar, and interplanetary radiations at wavelengths ranging from the EUV through the visible spectral regions. Four spectrometers with solar pointing control cover this broad region using channels with eighteen overlapping wave-length ranges with spectral resolution from 0.8 to 3.0 nm. Large dynamic ranges up to 10 exp (11) permit the measurement of very faint airglow or interplanetary radiation as well as intense solar emissions. The f/5 instrument consists of two separated units. Each contains two spectrometers based on Rowland circle geometry with toroidal gratings of R = 115.5 mm and 1200, 2400 (ASSI-A I/III) and 1200, 3600 lines/mm (ASSI-B II/IV) respectively. The holograph-formed lines of the gratings are curved when viewed at normal incidence to decrease aberration. Along each Rowland circle, four to five photoelectron multipliers maintain positions behind exit slits. There are eighteen detectors in all.

Ref.: Applied Optics, Vol. 24, No. 19, October 1985.

Instrument operation during the mission: all instruments operated properly throughout the mission with one exception. The WATI did not respond to power-on commands after April 30, due to a fuse failure.

VIII. Atmospheric Explorers

1. Mission Summary

The Atmosphere Explorer program was established to permit exploration and study of the thermosphere with emphasis on the lower altitude regions. To achieve these goals, the measurement—and hence the investigation range adopted—extended from a nominal low altitude of 150 km to an upper level of about 4000 thousand km, providing, for example, the capability of determining nearly vertical profiles of many constituents of the atmosphere. The decision to employ three satellites consecutively in orbits of polar, near-equatorial, and mid-latitude inclinations permitted an investigation range of global extent for establishment of the data base. Each of the three satellites had a variety of instruments to provide neutral and charged particle data concentrations and temperatures, the incident solar radiation, airglow, the low energy electron spectrum. Instrumentation also allowed concentration on chemical and energy conversion processes as well as the "aeronomy" and, to some extent, the dynamics, of the thermosphere.

Spacecraft and System Capabilities

The spacecraft control system made possible spinning (0.8 - 8 rpm) or despun (1 revolution per orbit) operation. The spin axis was maintained normal to the orbit plane to optimize the measurement environment, with stability maintained through use of a momentum wheel. The wheel permitted horizon scanning and the use of a solar aspect sensor for attitude determination. Magnetic torquers were used to control orientation, momentum, and spin rate as required. A hydrazine propulsion system (168 kg hydrazine) allowed orbit perigee and apogee altitude control, facilitating the attainment and maintenance of a 150 km perigee and later circular orbits at selected altitudes.

Surface-mounted solar cells provided power (100 watts @ 30% duty cycle for instruments). This also allowed measurements for a single complete orbit every third day as desired.

The use of a centralized computer for data storage and processing, with each PI having a full-time terminal, and a policy of fully sharing data among the investigators, was selected by the science team as the best approach in attaining the science goal of the project.

(Adapted from a longer report by N. W. Spencer in The IMS Source Book,, American Geophysical Union, 1982. See reference list below.)

2. Summary List of Investigators and Instruments

Investigation	Principal Investigator	Phone	Institution
Cylindrical Electro-static Probe	Brace, L. H.	301 286 8575	Goddard Space Flight Center
Bennett Ion Mass Spectrometer	Grebowsky, J.	301-286-6853	Goddard Space Flight Center
Low Energy Electrons	Hoffman, R. A.	301 286 7386	Goddard Space Flight Center
Neutral Atmosphere Composition Experiment	Hedin, A. E.	301 286 8393	Goddard Space Flight Center

Neutral Atmosphere Temperature Experiment	Spencer, N. W.	301 286 5001	Goddard Space Flight Center
Retarding Potential Analyzer	Hanson, W. B.	214 690 2851	Univ. of Texas at Dallas
Open Source Mass Spectrometer	Neir, A. O.	612 624 6366	Univ. of Minnesota
Solar EUV Spectrometer	Hinteregger,H. E.	617 377 3314	Air Force Geophysics Lab.
Solar EUV Photometer	Heath, D. F.	301 286 6421	Goddard Space Flight Center
Visible Airglow Photometer	Hays, P. B.	313 764 7220	Univ. of Michigan
Ultraviolet/NO (UNVO)	Barth, C. A.	303 492 8913	Univ. of Colorado
Photoelectron Spectrometer	Doering, J. P.	301 338 7445	Johns Hopkins University
Magnetic Ion Mass Spectrometer	Hoffman, J. H.	214 690 2884	Univ. of Texas at Dallas
Ion Gauge and Capacitance Manometer	Rice, C. J.	213 336 1749	Aerospace Corporation
Triaxial Accelerometers	Champion, K. S. W.	617 377 3033	Air Force Geophysics Lab.

3. Project Scientist

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Greenbelt, MD 20771
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SPAN PACF::SPENCER

4. Principal References

Spencer, N. W.., "The AE Mission During the IMS", The IMS Source Book, C. T. Russell and D. J. Southwood, eds., American Geophysical Union, 2000 Florida Ave. NW, Washington, DC, 20009, 1982 (21-26).

Into the Thermosphere, E. Burgess, D. Torr, eds., NASA SP-490, Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, 1987, 172 pp.

5. Mission Characteristics

Name	AE-C	AE-D	AE-E
Launch Date	Dec. 13, 1973	Oct. 6, 1975	Nov. 20, 1975
Status	Re-entered Dec. 12, 1978	Re-entered Mar. 12, 1976	Re-entered June 10, 1981
Apogee*	4300 km	3816 km	3025 km
Perigee*	270 km.	270 km.	270 km.
Inclination	68 degrees	90 degrees	19.7 degrees
Period	132 min.	126 min	118 min
Spin Vector	Perpendicular to orbit plane		
Spin Rate	One revolution per orbit		

*Many changes during lifetime using propulsion system as defined by scientific program needs.

6. Data Availability

The data generally exist as follows:

UNIFIED ABSTRACT FILE: ("UA FILE") Averaged geophysical data from all appropriate instruments filed at 15 second intervals (0, 15, 30, and 45 seconds of UT) to facilitate correlation of the data. These data reside in the NSSDC. An excellent database, used for most of the AE publications.

GEOPHYSICAL UNITS FILE: ("GU FILE") Reduced data of the highest resolution (at the times produced by the instrument). These data (known not to exist now for all instruments) generally are in the possession of the PI, and generally available on request.

RAW TELEMETRY: An effort is getting underway to commit these data to optical disc for future reference. Generally available for analysis if desired. Such efforts will be encouraged.

*U.S.GOVERNMENT PRINTING OFFICE:1990-261-276:20010

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- ❑ 4. NASA Center
- ❑ 5. Nonprofit Corporation
- ❑ 6. Other Government Agency
- ❑ 7. Private Industry
- ❑ 8. Small Business

Discipline (check all that apply)

- ❑ 1. Astronomy
- ❑ 2. Communications
- ❑ 3. Computer Sciences/ Information Systems
- ❑ 4. Environmental Observations
- ❑ 5. Life Sciences
- ❑ 6. Microgravity Sciences
- ❑ 7. Planetary Sciences
- ❑ 8. Solar and Space Physics

Program Involvement (check all that apply)

- ❑ 1. Principal Investigator
- ❑ 2. Co-Investigator
- ❑ 3. Management/Administration
- ❑ 4. General Interest
- ❑ 5. Flight Project
- ❑ 6. Suborbital Investigation
- ❑ 7. Data Analysis
- ❑ 8. Basic Research
- ❑ 9. Advanced Planning and Mission Definition
- ❑ 10. Science Working Group
- ❑ 11. American Astronomical Society Member

OSSA Involvement (check all that apply)

- ❑ 1. Astrophysics
- ❑ 2. Communications and Information Systems
- ❑ 3. Earth Science and Applications
- ❑ 4. Life Sciences
- ❑ 5. Microgravity Science and Applications
- ❑ 6. Shuttle Payload Engineering
- ❑ 7. Solar System Exploration
- ❑ 8. Space Physics
- ❑ 9. None

NASA Contractor/Grantee: ❑ Yes ❑ No

(If YES, please provide current NASA/OSSA Contract & Grant Numbers and Designate Level of Responsibility)

(P) — Principal Investigator (C) — Co-Investigator (L) — Team Leader

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